

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method for forming a thin high-k layer and a gate electrode on a substrate, the method comprising:
 - providing a substrate in a process chamber;
 - depositing a high-k material to at least a minimum thickness to form a thick complete high-k layer on the substrate;~~and~~
 - thinning the thick complete high-k layer across its entire surface to a desired thickness less than the minimum thickness but without complete removal to form a thin complete high-k layer that is continuous across its entire surface; and
 - depositing a gate electrode on the surface of the thin complete high-k layer.
2. (Original) The method according to claim 1, wherein the high-k material comprises Ta₂O₅, TiO₂, ZrO₂, Al₂O₃, Y₂O₃, HfSiO_x, HfO₂, ZrSiO_x, TaSiO_x, SrO_x, SrSiO_x, LaO_x, LaSiO_x, YO_x, or YSiO_x, or a combination of two or more thereof.
3. (Original) The method according to claim 1, wherein the minimum thickness of the thick complete high-k layer is between about 30 Å and about 200 Å.
4. (Original) The method according to claim 1, wherein the minimum thickness of the thick complete high-k layer is between about 50 Å and about 100 Å.
5. (Original) The method according to claim 1, wherein the depositing comprises thermal chemical vapor deposition, plasma-enhanced chemical vapor deposition, atomic layer deposition, or physical vapor deposition.
6. (Original) The method according to claim 1, wherein the desired thickness of the thin

complete high-k layer is between about 5 Å and about 50 Å.

7. (Original) The method according to claim 1, wherein the desired thickness of the thin complete high-k layer is between about 10 Å and about 30 Å.

8. (Original) The method according to claim 1, wherein the providing comprises providing a substrate having an interface layer formed on the substrate and the depositing comprises depositing the high-k material on the interface layer.

9. (Original) The method according to claim 8, wherein the interface layer comprises an oxide layer, a nitride layer, or an oxynitride layer, or a combination of two or more thereof.

10. (Original) The method according to claim 1, wherein the thinning comprises exposing the deposited high-k layer to a plasma process.

11. (Original) The method according to claim 10, wherein the plasma process comprises a process gas containing an inert gas.

12. (Original) The method according to claim 11, wherein the inert gas comprises He, Ne, Ar, Kr, or Xe, or a combination of two or more thereof.

13. (Original) The method according to claim 11, wherein the process gas further comprises a reactive gas.

14. (Original) The method according to claim 13, wherein the reactive gas comprises HCl, HBr, Cl₂, Br₂, C_xH_yX_z, or C_xH_yX_z, or a combination of two or more thereof.

15. (Original) The method according to claim 10, wherein the plasma process comprises etching the thick complete high-k layer in a reactive etching process.

16. (Original) The method according to claim 10, wherein the plasma process comprises modifying a portion of the thick complete high-k layer and removing the modified portion using wet processing.

17. (Currently Amended) A method for forming a thin hafnium-containing high-k layer and gate electrode on a substrate, the method comprising:

providing a substrate in a process chamber, the substrate having an interface layer formed thereon;

depositing a hafnium-containing high-k material to at least a minimum thickness necessary to form a thick complete hafnium-containing high-k layer on the interface layer in a TCVD process that is continuous across its entire surface; and

thinning the thick complete hafnium-containing high-k layer across its entire surface to a desired thickness less than the minimum thickness but without complete removal to form a thin complete hafnium-containing high-k layer that is continuous across its entire surface; and

depositing a gate electrode on the surface of the thin complete high-k layer.

18. (Original) The method according to claim 17, wherein the minimum thickness of the thick complete hafnium-containing high-k layer is between about 30 Å and about 200 Å.

19. (Original) The method according to claim 17, wherein the desired thickness of the thin complete hafnium-containing high-k layer is between about 5 Å and about 50 Å.

Application No. 10/711,721
Response dated June 11, 2007
to Office Action mailed January 10, 2007

20. (Original) The method according to claim 17, wherein the thinning comprises etching the deposited hafnium-containing high-k layer in a reactive etching process.

21. (Original) The method according to claim 17, wherein the thinning comprises modifying a portion of the thick complete hafnium-containing high-k layer in a plasma process and removing the modified portion using wet processing.